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ORIGINAL

FLOOD INSURANCE STUDY

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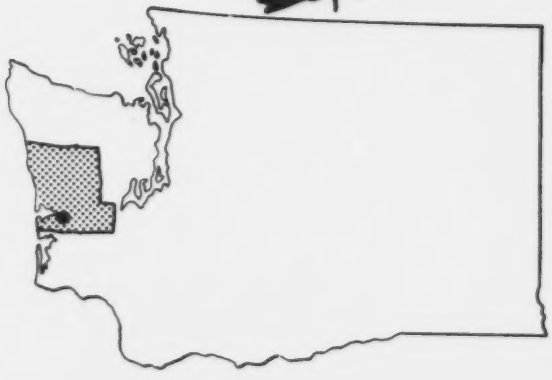

CITY OF COSMOPOLIS, WASHINGTON
GRAYS HARBOR COUNTY

MAY 3, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 530059

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530059 0001

PUBLISHED SEPARATELY:

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FLOOD INSURANCE STUDY
City of Cosmopolis, Washington

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Cosmopolis, Grays Harbor County, Washington, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Cosmopolis to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1(d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This study was started by Tippetts-Abbett-McCarthy-Stratton (TAMS) for the Federal Insurance Administration under Contract No. H-4022. Most of the cross section data were collected under this initial contract (Reference 1).

The hydrologic and hydraulic analyses for this study were completed by CH2M HILL, Inc., using the TAMS data. The work was performed

for the Federal Insurance Administration under Contract No. H-4810. This work, which was completed in March 1981, covered all significant flooding sources affecting the City of Cosmopolis.

1.3 Coordination

Representatives of the Federal Insurance Administration, the City of Cosmopolis, and TAMS originally identified the streams requiring detailed and approximate study. This meeting was held on April 8, 1976.

Representatives of CH2M HILL, Inc. and the City of Cosmopolis met on October 22, 1980, to discuss flood problems.

On October 21, 1981, the results of the study were reviewed at the final community coordination meeting. This meeting was attended by members of the City Council and representatives of the Federal Emergency Management Agency and the study contractor. The study was acceptable to the community.

The U.S. Army Corps of Engineers was contacted by CH2M HILL, Inc., for additional information pertinent to this Flood Insurance Study (References 2 and 3).

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Cosmopolis, Grays Harbor County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by the overflow of the following streams was studied in detail:

Chehalis River - entire reach within corporate limits

Mill Creek - from confluence with the Chehalis River to 250 feet above C Street

Tributary to Mill Creek at stream mile 0.15 - entire reach within corporate limits

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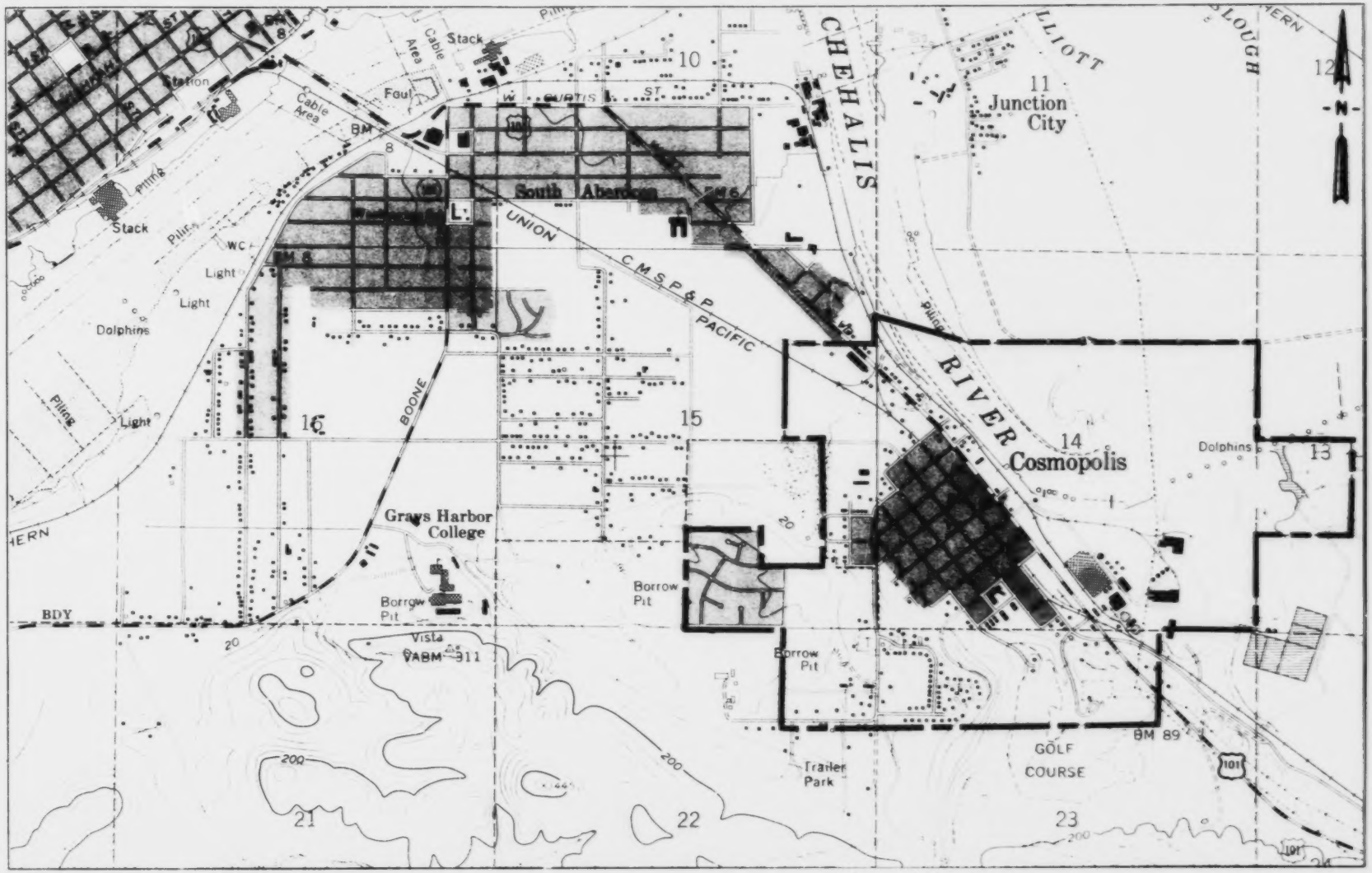

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF COSMOPOLIS, WA
(GRAYS HARBOR CO.)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

VICINITY MAP

Approximate methods were used to study Mill Creek from 250 feet above C Street to the corporate limits. In this section the stream is flowing through Mill Creek Park.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction for the next 5 years, through March 1986.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FIA and the City of Cosmopolis.

2.2 Community Description

The City of Cosmopolis is located in western Washington in the southwestern portion of Grays Harbor County. South Aberdeen is immediately west of Cosmopolis. Elsewhere the city is bounded by unincorporated areas of Grays Harbor County.

The city has developed on the south bank of the Chehalis River at River Mile 2.9 (Reference 4). The Chehalis River has a total drainage basin area of 2,114 square miles (Reference 2) and discharges into Grays Harbor. The river is tidally influenced in the Cosmopolis area.

Mill Creek leaves the hills south of Cosmopolis, flows through Mill Creek Park, and then continues northwest through the western part of the city. A tributary flowing southeast from South Aberdeen joins Mill Creek 0.15 mile above its confluence with the Chehalis River. A small concrete dam has been constructed on the stream in Mill Creek Park. The associated reservoir is for recreational purposes.

The Chehalis River flood plain has been developed in most of the city. Most of the industrial development has taken place in the eastern part of the city, south of the river. Industries in Cosmopolis are primarily related to forest products.

Commercial development has mainly occurred along U.S. Highway 101, and in some areas, development is within the Chehalis River flood plain. The area of the city that is north of the Chehalis River is undeveloped. The remaining portion of the city is predominantly residential. The residential areas in the northwest part of the city are in the Chehalis River flood plain.

Mill Creek flows through the park and residential areas. Property owners have built up to the channel banks along most of the stream.

The population in Cosmopolis in 1978 was 1,600 (Reference 5). The Cosmopolis Comprehensive Plan (Reference 5) estimates a projected population growth of 56 percent from 1970 to 1990.

Cosmopolis has a mid-latitude, west coast marine-type climate with warm and relatively dry summers and mild, wet, mostly cloudy winters. Normal annual precipitation is approximately 84.5 inches. Most precipitation occurs between October and March. During the winter, extremely heavy rainfall frequently is produced as heavily saturated airmasses are lifted orographically over the Olympic Mountains. The average daily maximum summer temperature is approximately 70° F, and temperatures occasionally rise above 90° F. The average daily maximum winter temperature is near 50° F, but temperatures can drop to near 0° F during cold periods (Reference 2).

The flood plain of the Chehalis River is largely underlain by alluvial silt and fine sand, locally with organic material. Some areas have been mantled by artificial fill. Close to the fairly abrupt boundary between the flood plain and the adjacent uplands, zones of coarse sand and gravel are probably interbedded with the finer grained materials (References 2 and 6).

2.3 Principal Flood Problems

Most of the floods on streams in the Cosmopolis area are caused by rainfall during the winter months, generated by Pacific weather fronts. Tidal influence from Grays Harbor extends up the Chehalis River to beyond the study limits.

Historically, flooding of Cosmopolis has been caused by high tides and riverflows. This can be aggravated during rainstorms by backup of the city's storm drainage system as intense local runoff is prevented from entering the river because of high water.

The highest river and harbor water stages in the Cosmopolis area result from a combination of high astronomical tides, low barometric pressure, and strong onshore winds. In the past, high tidal stages caused by this combination have resulted in extensive water damage to homes, businesses, and public property. High Chehalis River flows may coincide with high tides and aggravate flooding.

The highest observed tide at Grays Harbor occurred on December 17, 1933, and resulted in serious flooding in Cosmopolis. The 1933 flood had intense rainfall from December 16 through 22, and 90-mile-per-hour winds on December 17. During the storm, a record high tide of 9.9 feet was observed at the Port of Grays Harbor staff gage. Flooding in the Aberdeen-Cosmopolis area was a result of both high tides and high river-flows. The December 17, 1933, tide had a recurrence interval of approximately 80 years (Reference 7).

As an indication of frequency of high tide conditions at Cosmopolis, the 10 highest tides, measured at the Port of Grays Harbor staff gage in Aberdeen, are shown in Table 1 (Reference 3).

Flooding along the lower section of Mill Creek is due primarily to high water in the Chehalis River backing up the creek and inundating adjacent low areas.

The Cosmopolis City Engineer has indicated that there have been no flooding problems along Mill Creek due to the culverts for street crossings as long as the culverts are not blocked by trash. Some of the property owners in the reaches above those influenced by high

TABLE 1 - HIGHEST TIDES AT ABERDEEN

DATE	GAGE HEIGHT[a] (feet)	STAGE (feet)
December 17, 1933	15.8	9.9
December 1934	15.5	9.6
December 25, 1923	15.2	9.3
November 1913	15.2	9.3
November 1912	15.0	9.1
December 1920	14.9[b]	9.0
December 22, 1972	14.7	8.9
January 27, 1964	14.7	8.8
December 18, 1960	14.7	8.8
December 13, 1941	14.7	8.8

[a] Port of Grays Harbor staff gage at Pier No. 1, unless otherwise noted. In some years, gage reading may not be highest for the year since some high tides were not measured; gage datum (zero) equals 5.9 feet NGVD.

[b] U.S. Army Corps of Engineers staff gage; gage datum (zero) equals 5.8 feet NGVD.

water in the Chehalis River whose homes are located on low ground near the stream reported annual flooding of their basements.

2.4 Flood Protection Measures

A dike (elevation 8.9 feet) was built in 1978 to protect the area in northwestern Cosmopolis that is bounded on the south by Mill Creek, on the northeast by the Burlington Northern Railroad, on the north by the corporate limits, and on the west by the tributary to Mill Creek. This dike is insufficient to protect the area from floods with return periods of 20 years or greater.

The city has a flood control resolution which requires that low floor elevations be 2 feet above the 100-year flood elevation established by the U.S. Corps of Engineers for the Chehalis River.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

Discharges for the 25-, 50-, 100-, and 200-year floods on the Chehalis River were obtained from a 1975 report on the Chehalis River that was prepared by the U.S. Corps of Engineers (Reference 2). These flows were plotted on log-probability paper, and the resulting line was extrapolated to determine the 10- and 500-year floods.

Mill Creek is an ungaged stream. the 10-, 50-, 100-, and 500-year floods on it were determined by the application of the method described in the U.S. Soil Conservation Service publication Urban Hydrology for Small Watersheds, (Reference 8). This method includes the effects of soils, ground slope, drainage basin size and shape, and land use in the determination of runoff flows.

Peak discharge-drainage area relationships for the Chehalis River and Mill Creek are shown in Table 2.

TABLE 2 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (square miles)	PEAK DISCHARGES (cubic feet per second) 10-Year	50-Year	100-Year	500-Year
CHEHALIS RIVER					
At mouth	2,114	55,000	70,500	77,000	102,000
MILL CREEK					
Above Altenau Street	2.0	144	281	331	530

Flood damage from storms in coastal areas is the result of the combination of high stillwater levels and wave action. Stillwater is composed of astronomical tide, caused by gravitational effects of the sun and moon; storm surge, the rise in water level due to wind stress and low atmospheric pressure; and wave setup, an increase in water level due to shoreward mass transport of water. Tide gages measure stillwater levels. The runup of breaking waves can cause flooding and structural damage at elevations above the stillwater level of the flood.

The Grays Harbor tidal frequency analysis reported in Reference 2 was used in this study. That analysis was based on a record of the 15 highest tides observed at the Port of Grays Harbor staff gage during the period of 1912 to 1964. Predicted tide elevations are reported in Table 3.

TABLE 3 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
GRAYS HARBOR				
Port of Grays Harbor	8.8	9.7	10.0	10.5

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in Cosmopolis were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

The hydraulic analysis of the Chehalis River is based on the U.S. Army Corps of Engineers report, Special Study, Suggested Hydraulic Floodway Chehalis River Aberdeen to Satsop and Vicinity Grays Harbor County, Washington (Reference 3).

That report indicates that the tidal influence of Grays Harbor extends up the Chehalis River to Satsop. Since the Chehalis River is controlled by backwater from Grays Harbor, a Flood Profile for the Chehalis River is not shown in this study.

The tributary to Mill Creek flows only within the 100-year flood plain of the Chehalis River. The 100-year flow from the tributary would not cause flooding greater than that due to the 100-year flood from the Chehalis River. Therefore, no further hydraulic analysis was conducted for the tributary.

Water-surface elevations for Mill Creek were computed using the U.S. Army Corps of Engineers HEC-2 step-backwater computer program (Reference 9). Cross sections for the backwater analyses of Mill Creek (Reference 1) were field surveyed by TAMS under the original study contract and were visually checked by CH2M HILL, Inc. Additional cross sections

were field surveyed by CH2M HILL, Inc. to better approximate the shape of the flood channels.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel and overbank roughness factors (Manning's "n") for these computations were assigned on the basis of field inspection of flood plain areas. Manning's "n" values for Mill Creek varied from 0.035 to 0.045 in channel sections and from 0.05 to 0.08 in overbank areas.

Flood profiles were drawn showing computed water surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Starting water surface elevations for Mill Creek were assumed to be the 10-year tidal elevation.

All elevations are referenced from the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929; elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:1200, with a contour interval of 2 feet (Reference 10). In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year flood boundary has been shown.

For the streams studied by approximate methods, the boundary of the 100-year flood was developed from normal depth calculations and the topographic maps referenced above.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any

adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

With the approval of the Consultation Coordination Officer, no floodway was determined for the areas of the Chehalis River; they are all subject to tidal flooding.

The floodway for Mill Creek was computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 4).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE (FEET)
Mill Creek								
A	3850	13	59	5.7	10.7	10.7	10.8	0.1
B	4090	14	83	4.0	12.8	12.8	13.2	0.4
C	4200	14	87	3.8	13.0	13.0	13.5	0.5
D	4440	21	95	3.5	13.7	13.7	14.4	0.7
E	4660	18	96	3.5	14.3	14.9	14.3	0.6
F	4910	16	87	3.8	16.0	16.0	16.5	0.5
G	4970	16	82	4.1	16.1	16.1	16.6	0.5
H	5270	24	106	3.1	16.6	16.6	17.2	0.6
I	5370	49	144	2.3	16.8	16.8	17.4	0.6
J	5550	20	165	2.0	21.5	21.5	21.9	0.4
K	5760	23	164	2.0	21.6	21.6	22.1	0.5

[1] Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF COSMOPOLIS, WA
(GRAYS HARBOR CO.)

FLOODWAY DATA

MILL CREEK

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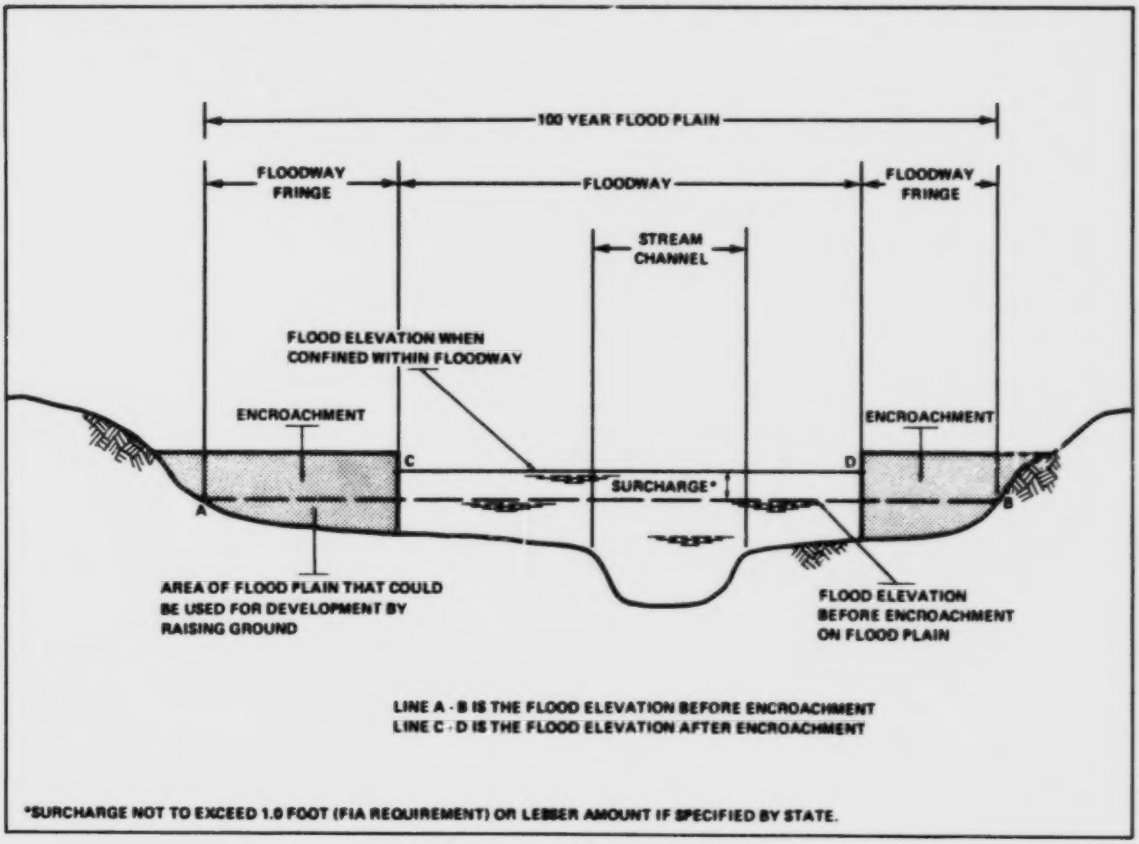
insurance zone designations for each significant flooding source affecting the City of Cosmopolis.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of Cosmopolis are shown on the Flood Profiles (Exhibit 1) and summarized in Table 5.

5.2 Flood Hazard Factors

The Flood Hazard Factor is used to correlate flood information with insurance rate tables.

Correlations between property damages from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Cosmopolis was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Grays Harbor (Backwater on Chehalis River and Mill Creek)	0001	-1.2	-0.3	0.5	010	A2	10
Mill Creek							
Reach 1	0001	-1.2	-0.2	0.3	010	A2	Varies - See Map
Reach 2	0001	-2.8	-0.5	0.5	030	A6	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF COSMOPOLIS, WA
(GRAYS HARBOR CO.)

FLOOD INSURANCE ZONE DATA

GRAYS HARBOR & MILL CREEK

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods, no base flood elevations shown or FHFs determined.
Zones A2 and A6:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones assigned according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water-control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or, areas subject to 100-year flooding from sources with drainage areas of less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 5, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Cosmopolis is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected

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whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines by the Federal Insurance Administration.

6.0 OTHER STUDIES

In 1975, the U.S. Army Corps of Engineers published the results of a flood control study in the South Aberdeen and Cosmopolis area (Reference 2). In this study, the 25-, 50-, 100-, and 200-year flows for Mill Creek just upstream of its mouth (tributary area 2.9 square miles) were estimated to be 315, 330, 345, and 370 cubic feet per second, respectively. The Rational Method (Q=CIA) was used to determine these flows. The method presented by the U.S. Soil Conservation Service in Technical Report No. 55 (Reference 8) is more detailed and was used to determine the exceedence-frequency curve for the flows in Mill Creek that was used in this Flood Insurance Study. The exceedence-frequency curve presented in the 1975 study for elevations of the Chehalis River at the mouth of Mill Creek was invalidated for the purposes of this study by the 1978 U.S. Army Corps of Engineers study on the Chehalis River from Aberdeen to Satsop (Reference 3). The flood elevations presented in the 1978 study agree with those used in this Flood Insurance Study.

The only other published flood information for Cosmopolis is the Flood Hazard Boundary Map issued by the Federal Insurance Administration (Reference 11). Because it is a more detailed analysis, this Flood Insurance Study supersedes the previously published map.

Flood Insurance Studies are currently being conducted for the City of Aberdeen and the unincorporated areas of Grays Harbor County (References 12 and 13). The results of these studies will be in complete agreement with the Cosmopolis study.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Federal Regional Center, 130 228th Street SW, Bothell, Washington 98011.

8.0 BIBLIOGRAPHY AND REFERENCES

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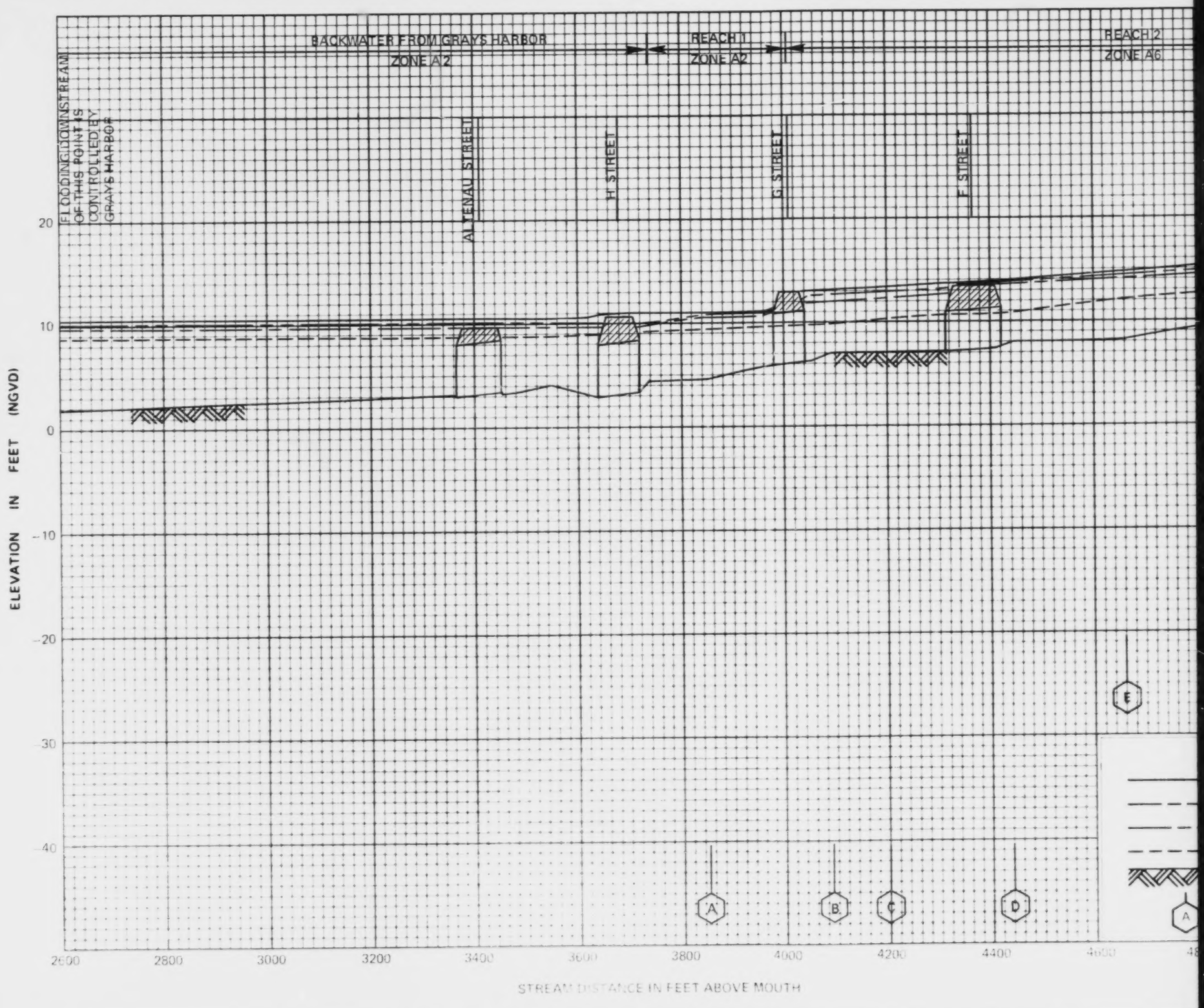
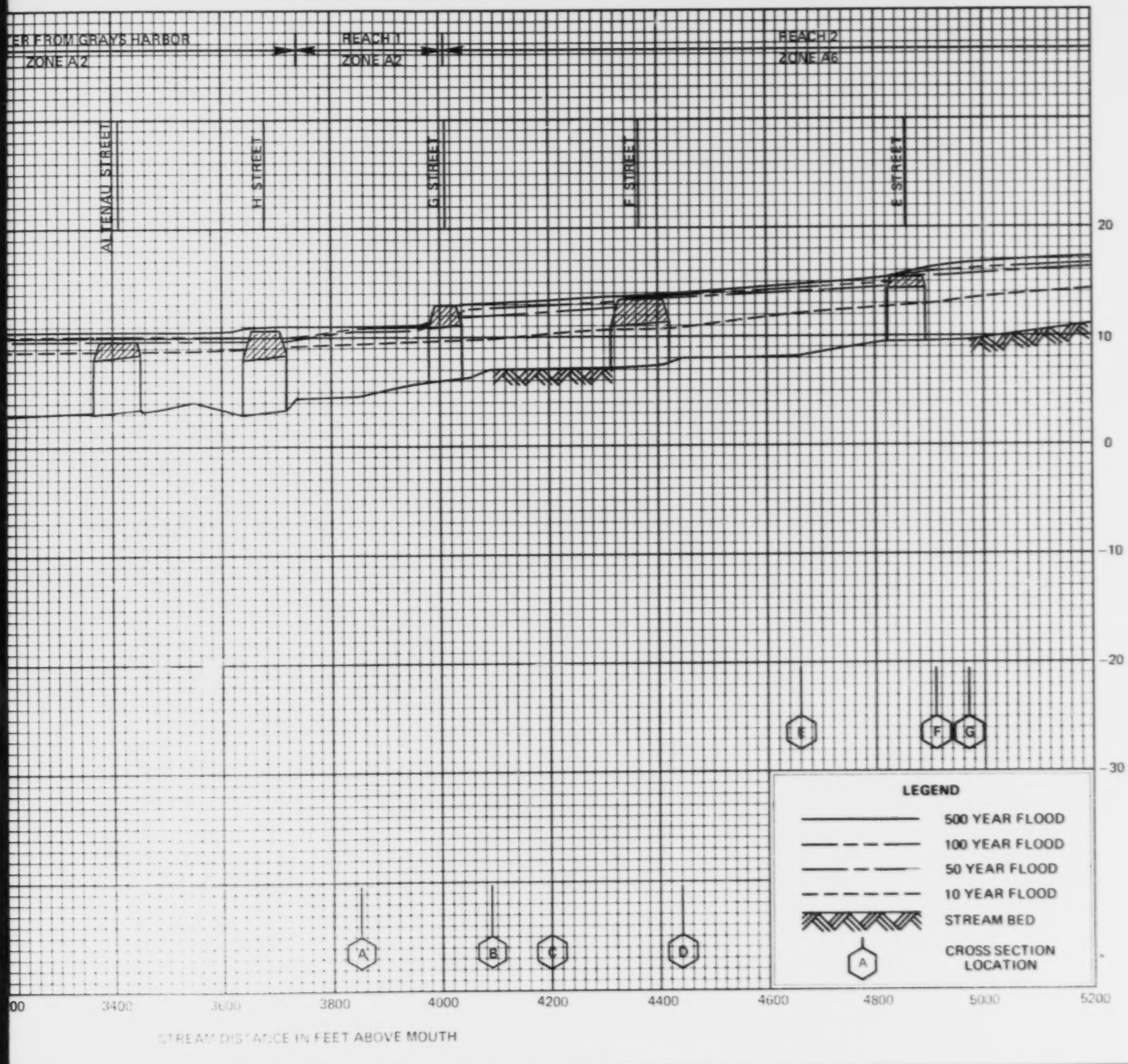

BACKWATER FROM GRAYS HARBOR
ZONE A2
REACH 1
ZONE A2
REACH 2
ZONE A6
FLOODING DOWNSTREAM OF THIS POINT IS CONTROLLED BY GRAYS HARBOR
ALTENAU STREET
H STREET
G STREET
F STREET
ELEVATION IN FEET (NGVD)
20
10
0
-10
-20
-30
-40
2600
2800
3000
3200
3400
3600
3800
4000
4200
4400
4600
STREAM DISTANCE IN FEET ABOVE MOUTH
A
B
C
D
E
A

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF COSMOPOLIS, WA
(GRAYS HARBOR CO.)

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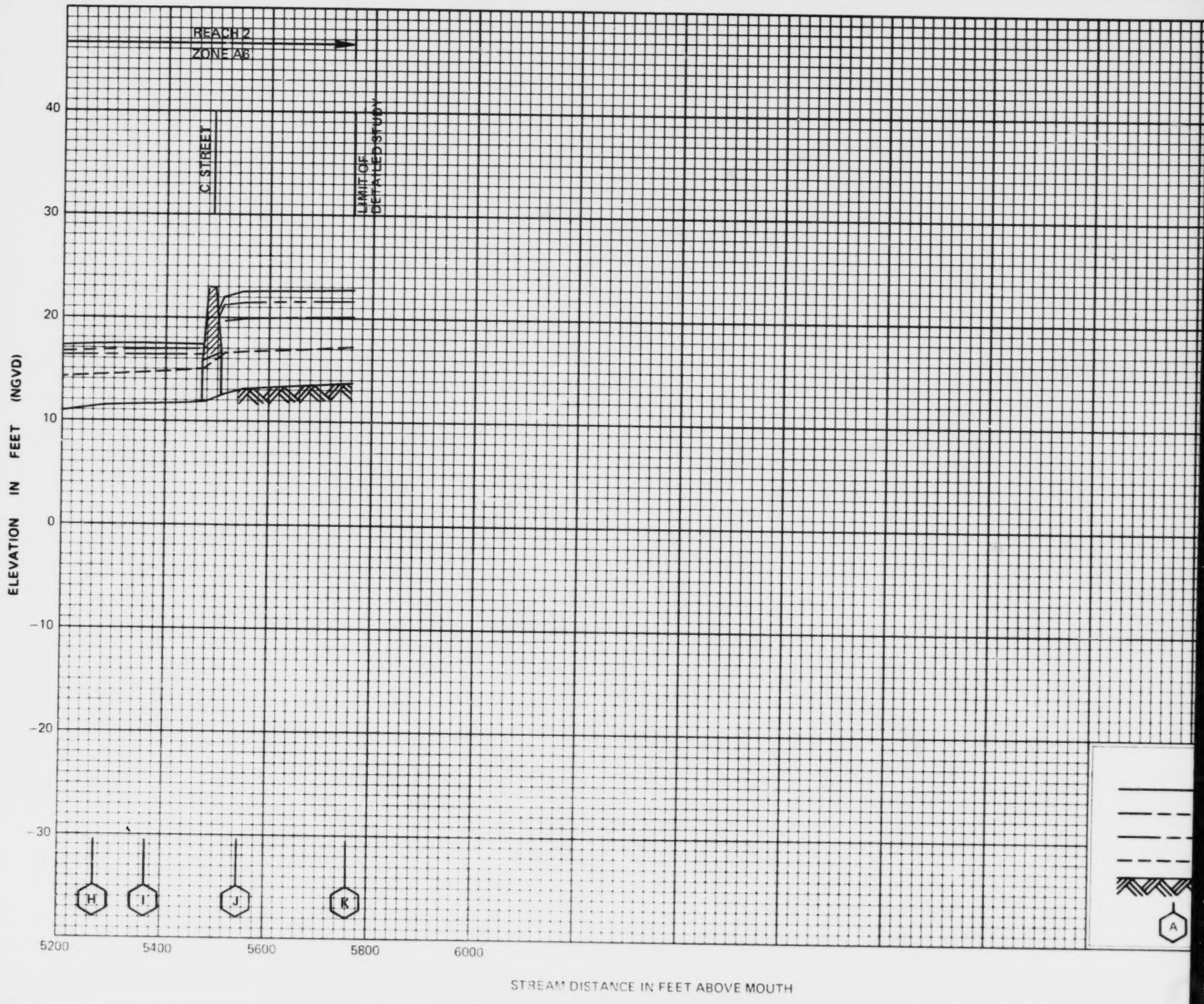
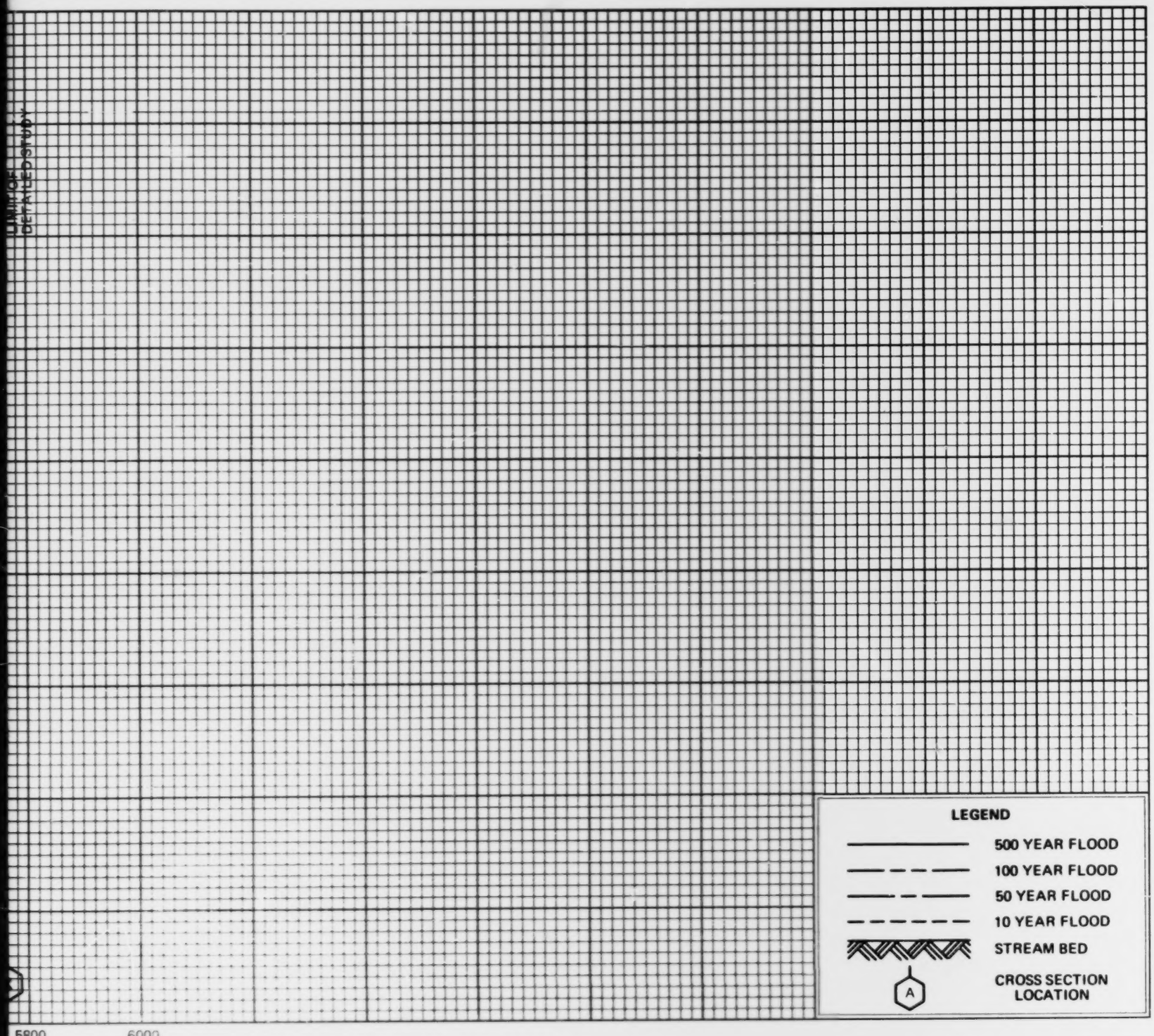

REACH 2
ZONE A6
C STREET
LIMIT OF DETAILED STUDY
40
30
20
10
0
-10
-20
-30
ELEVATION IN FEET (NGVD)
H
I
J
K
A
5200
5400
5600
5800
6000
STREAM DISTANCE IN FEET ABOVE MOUTH

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

MILL CREEK

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02P